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**Dataset Information:**

Funding\_Info: NOAA Climate Program Office; NOAA Ocean Acidification Program  
Initial\_Submission: 2010mmdd  
Revised\_Submission: 2010mmdd

**Cruise Information:**

Experiment Name: GU1001\_leg3  
Experiment Type: Research Cruise  
Platform Type: Ship  
Co2 Instrument Type: Equilibrator-IR or CRDS or GC

Cruise ID: 33GG20100502  
Cruise Info: AOML\_SOOP\_CO2  
Geographical Region:

Westernmost Longitude: -96.1  
Easternmost Longitude: -86.9  
Northernmost Latitude: 30.4  
Southernmost Latitude: 25.9

Cruise Dates (YYYYMMDD)

Start\_Date: 20100512  
End\_Date: 20100524

Ports of Call:

Pascagoula, MS

Vessel Name: R/V Gordon Gunter  
Vessel ID: 33GG  
Vessel Owner: NOAA

## Variables Information:

Variable Name: xCO2\_EQU\_ppm

Description of Variable: Mole fraction of CO2 in the equilibrator headspace (dry) at equilibrator temperature (ppm)

Unit of Variable: ppm

Variable Name: xCO2\_ATM\_ppm

Description of Variable: Mole fraction of CO2 measured in dry outside air (ppm)

Unit of Variable: ppm

Variable Name: xCO2\_ATM\_interpolated\_ppm

Description of Variable: Mole fraction of CO2 in outside air associated with each water analysis. These values are interpolated between the bracketing averaged good xCO2\_ATM analyses (ppm)

Unit of Variable: ppm

Variable Name: PRES\_EQU\_hPa

Description of Variable: Barometric pressure in the equilibrator headspace (hPa)

Unit of Variable: hPa

Variable Name: PRES\_ATM@SSP\_hPa

Description of Variable: Barometric pressure measured outside, corrected to sea level (hPa)

Unit of Variable: hPa

Variable Name: TEMP\_EQU\_C

Description of Variable: Water temperature in equilibrator (°C)

Unit of Variable: Degree C

Variable Name: SST\_C

Description of Variable: Sea surface temperature (°C)

Unit of Variable: Degree C

Variable Name: SAL\_permil

Description of Variable: Sea surface salinity on Practical Salinity Scale (o/oo)

Unit of Variable: ppt

Variable Name: fCO2\_SW@SST\_uatm

Description of Variable: Fugacity of CO2 in sea water at SST and 100% humidity (µatm)

Unit of Variable: µatm

Variable Name: fCO2\_ATM\_interpolated\_uatm

Description of Variable: Fugacity of CO2 in air corresponding to the interpolated xCO2 at SST and 100% humidity (µatm)

Unit of Variable: µatm

Variable Name: dfCO2\_uatm

Description of Variable: Sea water fCO2 minus interpolated air fCO2 (µatm)

Unit of Variable: µatm

Variable Name: WOCE\_QC\_FLAG

Description of Variable: Quality control flag for fCO2 values (2=good, 3=questionable)

Unit of Variable: None

Variable Name: QC\_SUBFLAG

Description of Variable: Quality control subflag for fCO2 values, provides explanation when QC flag=3

Unit of Variable: None

## Method Description:

### Equilibrator Design:

Depth of Seawater Intake: 5 meters

Location of Seawater Intake: Bow

Equilibrator Type: Sprayhead above dynamic pool, no thermal jacket

Equilibrator Volume: 0.95 L (0.4 L water, 0.55 L headspace)

Water Flow Rate: 1.5 - 2.0 L/min

Headspace Gas Flow Rate: 70 - 150 ml/min

Vented: Yes

Drying Method for CO<sub>2</sub> in Water:

Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

Additional Information: Primary equilibrator is vented through a secondary equilibrator.

### CO<sub>2</sub> in Marine Air:

Measurement: Yes, 5 readings in a group every 3 hours

Location and Height: Bow mast, ~18 meters above sea surface

Drying Method:

Gas stream passes through a thermoelectric condenser (~5 °C) and then through a Perma Pure (Nafion) dryer before reaching the analyzer (90% dry).

### CO<sub>2</sub> Sensor:

Measurement Method: IR

Manufacturer: LI-COR

Model: 6262

Frequency: Every 140 seconds, except during calibration

Resolution Water:  $\pm 0.01 \mu\text{atm}$  in fCO<sub>2</sub>\_SW

Uncertainty Water:  $\pm 2 \mu\text{atm}$  in fCO<sub>2</sub>\_SW

Resolution Air:  $\pm 0.01 \mu\text{atm}$  in fCO<sub>2</sub>\_ATM

Uncertainty Air:  $\pm 0.5 \mu\text{atm}$  in fCO<sub>2</sub>\_ATM

Manufacturer of Calibration Gas:

Std 1: LL100000, 0.00 ppm, owned by AOML, used every ~2.5 hours. Std 2: JA02280, 248.73 ppm, owned by AOML, used every ~2.5 hours. Std 3: JA02292, 372.88 ppm, owned by AOML, used every ~2.5 hours.

Number of Non Zero Gas Standards: 2

CO<sub>2</sub> Sensor Calibration:

The analyzer is calibrated every 4.5 hours with field standards that in turn were calibrated with primary standards that are directly traceable to the WMO scale. The zero gas is ultra-high purity air.

Other Comments:

Instrument is located in an air-conditioned laboratory. Ultra-High Purity air (0.0 ppm CO<sub>2</sub>) and the high standard gas are used to zero and span the LI-COR analyzer.

Method References:

Pierrot, D., C. Neil, K. Sullivan, R. Castle, R. Wanninkhof, H. Lueger, T. Johannessen, A. Olsen, R. A. Feely, and C. E. Cosca (2009), Recommendations for autonomous underway pCO<sub>2</sub> measuring systems and data reduction routines, Deep-Sea Res II, 56, 512-522.

Details Co<sub>2</sub> Sensing:

details of CO<sub>2</sub> sensing (not required)

Measured Co<sub>2</sub> Params:

xco2(dry)

Sea Surface Temperature:

Location: hull mounted, ~3 m below sea surface

Manufacturer: Furuno

Model: T2000

Accuracy Degrees Celsius: 0.2

Precision Degrees Celsius: 0.1

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Equilibrator Temperature:

Location: Inserted into equilibrator ~5 cm below water level

Manufacturer: Omega

Model: PR-11-2-100-1/8-9-E

Accuracy Degrees Celsius: 0.15

Precision Degrees Celsius: 0.01

Calibration: Factory calibration

Comments: Resolution is taken as Precision.

Equilibrator Pressure:

Location: Attached to equilibrator headspace

Manufacturer: Vaisala

Model: PTB210

Accuracy hPa: 0.25

Precision hPa: 0.01

Calibration: Factory calibration

Comments:

Absolute pressure reading. Manufacturer's Resolution is taken as Precision.

Atmospheric Pressure:

Location: Next to the bridge, ~15 m above the sea surface water

Manufacturer: Druck

Model: RPT350

Accuracy:  $\pm 0.08$  hPa

Precision: 0.01 hPa

Calibration: Factory calibration

Normalized: yes

Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

Sea Surface Salinity:

Location: In Chem lab, next to CO2 system

Manufacturer: Seabird

Model: SBE 21

Accuracy:  $\pm 0.05$  o/oo

Precision: 0.002 o/oo

Calibration: Factory calibration

Comments: Manufacturer's Resolution is taken as Precision; Maintained by ship.

**Additional Information:**

Computer time had to be adjusted by comparing temperature records of pCO2 and TSG systems. GPS data was merged in from TSG system using the adjusted computer time. Atmospheric pressure data obtained from NCEP/NCAR Reanalysis 2 product (<http://www.esrl.noaa.gov/psd/data/gridded>)

/data.ncep.reanalysis2.surface.html) was compared to the LICOR pressure and deemed to agree fairly well with an offset of 1 mbar. The ATM pressure was estimated by adding 1 mbar to the LICOR pressure which reproduced the daily variations better than the NCEP pressures. SST was approximated by the internal temperature sensor of the TSG. only 2 non zero standards Original Data Location: [http://www.aoml.noaa.gov/ocd/ocdweb/gunter/gunter\\_introduction.html](http://www.aoml.noaa.gov/ocd/ocdweb/gunter/gunter_introduction.html)

**Preliminary Quality Control:**

NA

**Form Type:**

underway